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Fresh Flow: Where The City Meets The Sea

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Louisiana State University and Agricultural and Mechanical College

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FRESH FLOW: WHERE THE CITY MEETS THE SEA

A Thesis

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Master of Landscape Architecture

in

Department of Landscape Architecture

by

Wanqin Su

B.E. in Landscape Studies, Tongji University, 2014

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Abstract

The significance of this site lies in its location. It is three miles away from French Quarter, the heart and origin of the city, and eight miles away from Lake Borgne, as well as the Gulf. Regardless of the size, it distinguishes itself on the map as a wedge of green space inserted sharply into densely developed urban space.

The site was prosperous cypress swamp six decades ago, too dense to identify lands and water underneath. However, after the Mississippi River Gulf Outlet was dug in the 1960s, it took less than 30 years for it to transformed into brackish open water. [11] The transformation was disastrous. First of all, the eco-system has been severely damaged. According to a group of researchers from University of Wisconsin-Madison, the fresher the water is, the more diverse the eco-system will be [11].

Besides the irreversible damage done to the ecosystem, loss of vegetation resulted in a huge loss of joyous space for the neighborhood. Senior residents still keep the memories of a cypress swamp as a place for recreation and production. Unfortunately, as the vegetation degraded, the role of BBTW changed from protection to the opposite. The force of surge aggregated in this open water pond, posing threats to the vulnerable low-lying neighborhood. After 1960s, a six-feet still wall has been put between BBTW and the neighborhood, reversed its protective function in the face of surges from the Gulf.

To protect the neighborhood, Bayou Bienvenue Triangle Wetlands is a creation of men and nature. It was developed as the city's drainage outlet into the Gulf of Mexico, to carry excessive amount of water due to the unique location of New Orleans. The city, New Orleans, once thrived as the confluence of the Mississippi River, one of the most extensive water systems in the world, and the ocean. The rapid growth in New Orleans shipping activities resulted in extensive dredging and canaling activities in the area between the city and the Gulf. When more and more heavy-loaded ships managed to get to the river, the water from the ocean intruding further and further into coastal wetlands systems, transforming enormous amount of marshes and swamps into open water. According to

surveys conducted by USGS, Louisiana 3 million acres of wetlands are lost at the rate about 75 square kilometers annually, but reducing these losses is proving to be difficult and costly [6]. In this huge devastation of coastal wetlands, 472-acre Bayou Bienvenue Triangle Wetlands(BBTW), the site of this thesis, is a small patch on the map. But is big enough to make a difference.

Chapter 1

Introduction

The site, 472-acre Bayou Bienvenue is an overflow of Bayou Bienvenue. Bayou Bienvenue, a 12.1-mile waterway [7], is the confluence of the New Orleans urban drainage system and the Gulf. One end of this Bayou is the outlet of Pumping Station No.5, which drains all the surface flow of the Lower Ninth Ward (LNW, Approximately 1,900 acres, measured from Google Earth), one of the impoverished neighborhood in New Orleans. The other end of the Bayou goes into Lake Borne, one of the biggest salt water lakes along the Gulf. Within Bayou Bienvenue Wetlands Triangle is a battle between saltwater from the Gulf and freshwater from the community. During the past six decades, this site has been transformed from a freshwater cypress forests to a open brackish pond, caused by drastically increasing amount of salt water intruding from the Gulf. Hurricane Katrina in 2005 brought to public realization the significance of coastal wetlands, leading to various efforts to recover the coastal wetlands. This project is working on managing the water system within the site to recover the freshwater ecosystems, providing a valuable amenity for LNW, as well as the city of New Orleans.

The site occupies a very unique location within the extensive Louisiana coastal wetlands system due to its adjacency to the CBD and the French Quarter in New Orleans. Bayou Bienvenue Wetlands Triangle locates at the immediate east of the Industrial Canal, 3 miles down the Mississippi River from the French Quarter, the earliest settlement of New Orleans. Bayou Bienvenue is located at the northwest of the Triangle, charging it with fresh and salt water through three openings at the spoiled bank. The transaction of water in this area is affected by the activities of Pumping Station No.5 and tidal influence the Gulf. After the closure of MRGO in 2009, the salinity of water bodies between the Mississippi River and the Gulf decreases drastically.

The South of the Triangle is the Lower Ninth Ward(LNW), one of the most isolated neighborhoods in New Orleans. This neighborhood has always suffered a greater loss from Hurricane Katrina compared to most areas in New Orleans, as a result of its problematic geographical location, lack of legitimate infrastructure, and underprivileged socio-economic status of the residents. One of the goals of this project is to transform BBWT to amenity with convenient access for the LNW, by programming several sites designated for residents' activities and educational programs.



Figure 1.1: The map of Bayou Bienvenue site

This Triangle witnessed the development of industrial and residential areas of LNW, as well as the nuisances such as the East Bank Wastewater Treatment Plant(EBWWTP), The Southern Scarp Metal Recycling, and the Crescent Acre Landfill. the city during its urbanization [5]. In 1899, four years after a world-class urban drainage plan was proposed for New Orleans, Pumping Station No.5 was completed and connected to Bayou Bienvenue, diverting water out of the city during rainfall. The canal built to connect the pumping station and Bayou Bienvenue created angle shape [8]. When Crescent Acre Landfill(CAL) was built at the boarder or Orleans Parish, a Triangle Shaped Wetlands was created, later became known as Bayou Bienvenue Wetlands Triangle. Later, in 1923, the Industrial Canal was built to relief the old dock space and to provide employment opportunities for citizens, separating the Lower Ninth from the rest of the Ward, thereby distinguishing the poorest of the poor. East Bank Waste Water Treatment Plant(EBWWT) was completed in 1973,

dealing with all the sewerage from the east bank of Orleans Parish. Ten years later, in 1983, Crescent Acre Landfill was open [8], isolated this 472-acre wetland from the rest of the Mississippi Central Wetlands System.

Nowadays, as the Lower Ninth Ward slowly recovers, new projects are built and being built close to the Triangle, including a wooden platform, Lee Play Ground, Dr. Martin Luther King Jr. Charter High School and so on, bringing more and more attention and visitors to this wetlands triangle, making it a great site for tourism and education.

Future challenges posed by sea level rise, coast erosion and increasing frequency of hurricanes require immediate action to preserve the neighborhood and the city. This thesis explores how to make use of the tremendous amount of fresh water coming from Pumping Station No.5 and the EBWWTP to accelerate the recovery of freshwater ecosystems in Bayou Bienvenue Wetlands Triangle, making it a tourism attraction, an educational site and an amenity for adjacent neighborhoods and the city of New Orleans. The whole writing includes site inventory and analysis, description of design strategies and impact estimate. The research was conducted by site observations, interviews, exploring pertinent investigations, studying relevant cases, formal interviews, archival researches, precedence reference, as well as site and participants, observation.

Chapter 2

Site Inventory and Analysis



Figure 2.1: Site Inventory and Analysis

2.1 History: From Vast Cypress Forest To A Degraded Wetlands Triangle

This area has been modified by human and nature drastically since 1895, when pumping station No.5 was constructed and connected to Bayou Bienvenue [8]. In 1923, Completion of Inner Harbor Navigation Canal connected the Mississippi River to Lake Pontchartrain, as well as separate LNW from the rest of the city. Since then, the west bank of IHNC has been developed, populated and gentrified. While the east bank of IHNC, especially LNW, has been left behind during urban development, but heavily born the burden of unwanted facilities. The BBWT shared the fate.

2.1.1 The Formation of an Angle Towards the City: A Linkage Between the City and the Gulf

The site for the city of New Orleans was chosen for its fantastic location. It is where the ships coming from the ocean entered the most magnificent water system, the Mississippi River, on this continent. This brilliant choice made in 1718 by French colonials foresaw a shipping empire for the next century. According to Richard Campanella, a farther upriver site would have been too inconvenient for coastal traffic and unable to answer enemy incursions; a farther east or west site would relinquished the critical Mississippi River advantage and still suffered flooding problems; a farther downriver site would be more vulnerable and precarious? [5]. This information can be seen in the following table [8]. The

following table is the table of Historical Floods In New Orleans Caused By Over Flow Of The Mississippi River [9]

Table 2.1: A table of weather variable criteria		
Year	Month	Description
1734-35	Dec - June	City of New Orleans was inundated for several months [Hoyt]
1788	July	Severe flooding of the Mississippi River due to a landfalling hurricane's surge. Aid given to Acadian settlers at Fort Bute, Manchac and Baton Rouge. The settlers had arrived in 1785. [theCajuns.com]
1882	March	Lower Mississippi Valley flooded; private levee failures. [Hoyt, O'Brien]
1928	-	Construction starts on the Bonnet Carre Spillway. Located 23 miles upriver from New Orleans in St. Charles Parish. This gate controlled outlet can divert 250,000 cubic feet of water per second into Lake Pontchartrain. The flow, at full capacity, is twice the flow of Niagara Falls. [USACE-MVN]

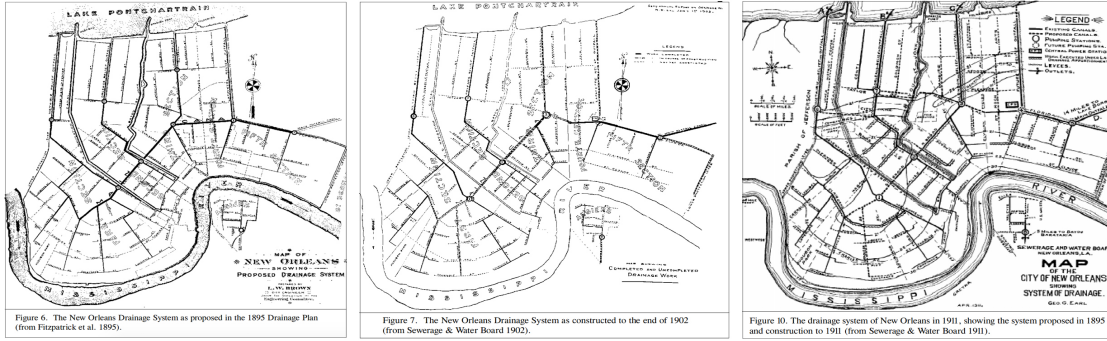


Figure 2.2: New Orleans Drainage System

However, water brought fortune, as well as hazards. Connecting the river and the ocean, the city was vulnerable to any water related hazards. The existence of the city depended on the sediments deposited by floods from the Mississippi River. New Orleans history is built on its relationship with water. Floods caused by the river, thunderstorm and hurricane jeopardized its residents and property. When hundreds of miles of levees managed to protect the city from the river, lack of sediment deposition results in subsidence, which makes the city more vulnerable to flood and hurricanes.

To deal with its problems with water, a superior urban drainage plan was proposed in 1895. In this plan, the 1.4-mile Outfall Canal was dug to connect the city's drainage system to Bayou Bienvenue. One end of the Outfall Canal is the Pumping Station No.5, the other end leads to Bayou Bienvenue. As a conduit, the canal delivers water further into Lake Borgne, forming an angle of nowadays Bayou Bienvenue Wetlands Triangle(BBWT), pointing right at the heart of the city. [8]. Although the plan had been altered multiple times during construction, it distinguished Bayou Bienvenue from numerous bayous spreading from the Mississippi River to Lake Borgne. This Outfall Canal is often considered a part of Bayou Bienvenue. The dredged material was deposited along side, creating a spoiled bank between Bayou Bienvenue and the rest of the wetlands.

2.1.2 A Century of Water System Engineering: Connections and Separations

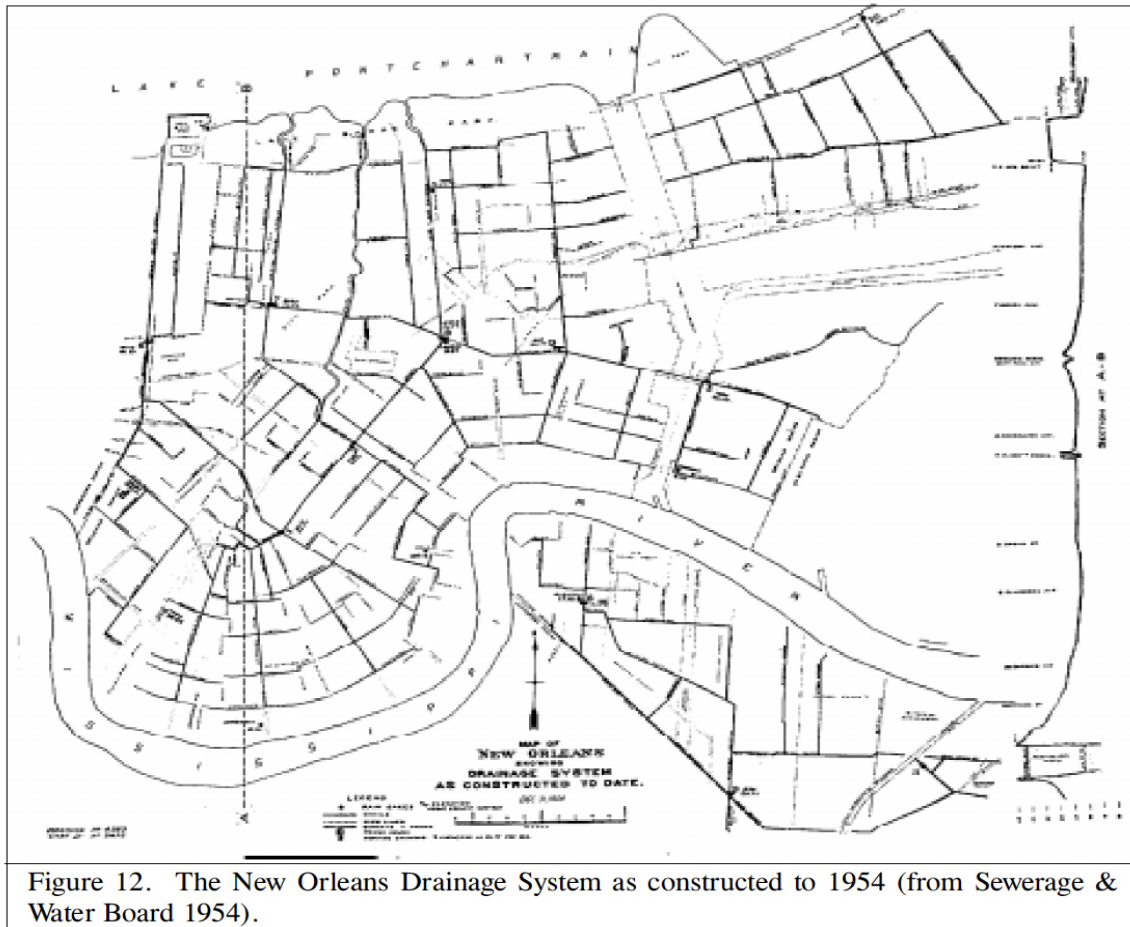


Figure 12. The New Orleans Drainage System as constructed to 1954 (from Sewerage & Water Board 1954).

Figure 2.3: Evaluation of New Orleans Drainage System

It did not take long before New Orleans became a shipping Empire on the Gulf. The active ports brought in people from around the world, helping New Orleans create a diverse and unique culture of its own. The rapidly growing population demanded more urban space, as well as better protection from flooding. The elevated area along the natural levee was soon taken, leaving unwanted lower grounds with inferior drainage for the poor [8].

In 1923, the Inner Harbor Waterway(IHWW) was built, after which Bayou Bienvenue was no longer linked to major drainage system of the city [2]. The function of the bayou narrowed to all the surface flow from the Lower Ninth Ward. The IHWW also connected the bayou to the Mississippi River, judging from early maps and aerial images. This connection

ended between 1932 and 1939, around the time when the Intracoastal Waterway, one mile away from Bayou Bienvenue, was completed. The intention of IHWW was to connect the Mississippi River and Lake Pontchartrain, to relieve the congestion of old ports and to generate employment in the most underdevelopment part of the city [5]. The location of this Canal was in the middle of the Ninth Ward, the farthest down river part inside the city's administrative boundary. Sitting in the middle of the Ninth Ward, excavation of this canal brought profound consequences to both banks. The Lower Ninth Ward was separated from the Upper Ninth, as well as the city. The streets that run in the LNW maintained the original name, but were cut off by IHWW. Nowadays, the broken streets with the same name are still all over the city, as well as the LNW. IHWW's impact is much more tremendous than the separation of the LNW. By separating this ward, IHWW also alienated coastal wetlands and the Gulf. In the following decades, the events on the other side of the IHWW are rendered rather irrelevant for most New Orleanians. The Lower Ninth Ward only came to public attention when huge fatal catastrophes struck, such as Hurricane Betsy in 1965 and Hurricane Katrina in 2005, when the whole neighborhood was inundated, people began to realize that the coastal areas share the same fate in the face of numerous future challenges caused by changing climate, costal erosion and the absence of natural protection. The city is always aware of the threats posed by its disadvantage elevation. It is surrounded by water from south (the Mississippi River), north (Lake Pontchartrain) and east (the Gulf), and the city's low parts are lower than all of them. But surrounded by hundreds of miles of levees, water is barely seen inside the city. IHWW managed to relocate the waterway traffic from the center of the city (downtown and French Quarter), where even today ships can be seen and heard.

2.1.3 MRGO and Salt Water Intrusion

The impact of the MR-GO on salinity also is evidenced by the decrease of salinity from thirty-two percent to sixty-six percent after the Army Corps closed the MR-GO in 2008–2011.

Yearly Average Salinity (ppt) Pre- and Post-MRGO's Closure			
Location	Pre-Closure	Post-Closure	% Change
Bayou La Loutre	17.01	8.87	48%
Lake Borgne	8.16	5.62	32%
Central Wetlands	14.67	5.26	64%
GIWW	14.72	5.07	66%
Lake Pontchartrain	6.12	4.01	35%

2010 DRAFT EIS at 3-33 tbl. 3-14; *see also* 1972 BASELINE STUDY at 90 (comparing monthly salinity ranges at Hopedale before and after the construction of the MR-GO, using 1957–1967 Army Corps data); *see also* 1972 BASELINE STUDY at 91 (comparing monthly salinity ranges at the Paris Road Bridge before and after the construction of the MR-GO, using 1948–1967 Army Corps data).

Figure 2.4: A statistic table of Salt Water Intrusion [1]

Between 1958-1967, the Mississippi River Gulf Outlet (MRGO) was being built as a short cut between the Gulf and the Mississippi River. By dissecting extensive fresh water systems, MRGO directly connected fresh water system to the Gulf, resulting in an enormous wetland loss along the Gulf. According to a serial of satellite Images, the wetlands started to transformed into open water around this time. After 1976, three openings were cut in the Spoiled Bank, enabling salt water to enter the Bayou Bienvenue Triangle Wetlands. By 1989, the 472-acre former prosperous wetland was totally invisible, replaced with a brackish pond surrounded by the spoiled bank, Crescent Acre Landfill, and East Bank Wastewater Treatment Plant [11]).

According to Amanda Moore from National Wildlife Federation(NWF), the construction and operation of MRGO had impacted more than 618,000 acres of coastal habitat. The width of MRGO has expanded from no more than 650 feet, when first constructed, to more than 3000 feet in some areas [10].

2.1.4 The Realization and Aftermath: Hurricane Katrina

The debate over the closure of MRGO started since the first day of its construction. However, coastal Louisiana witnessed more than 50 years of the existence MRGO since the construction started in 1958. The tragedy of Katrina shocked the whole nation, bringing unprecedented attention and preservation interest to the coast of Louisiana. After Hurricane Katrina, Army Corp of Engineers decided to close this controversial waterway as a mitigation to costal wetlands degradation, followed by a preservation plan from CPRA (Coastal Protection and Preservation Authority) [3].

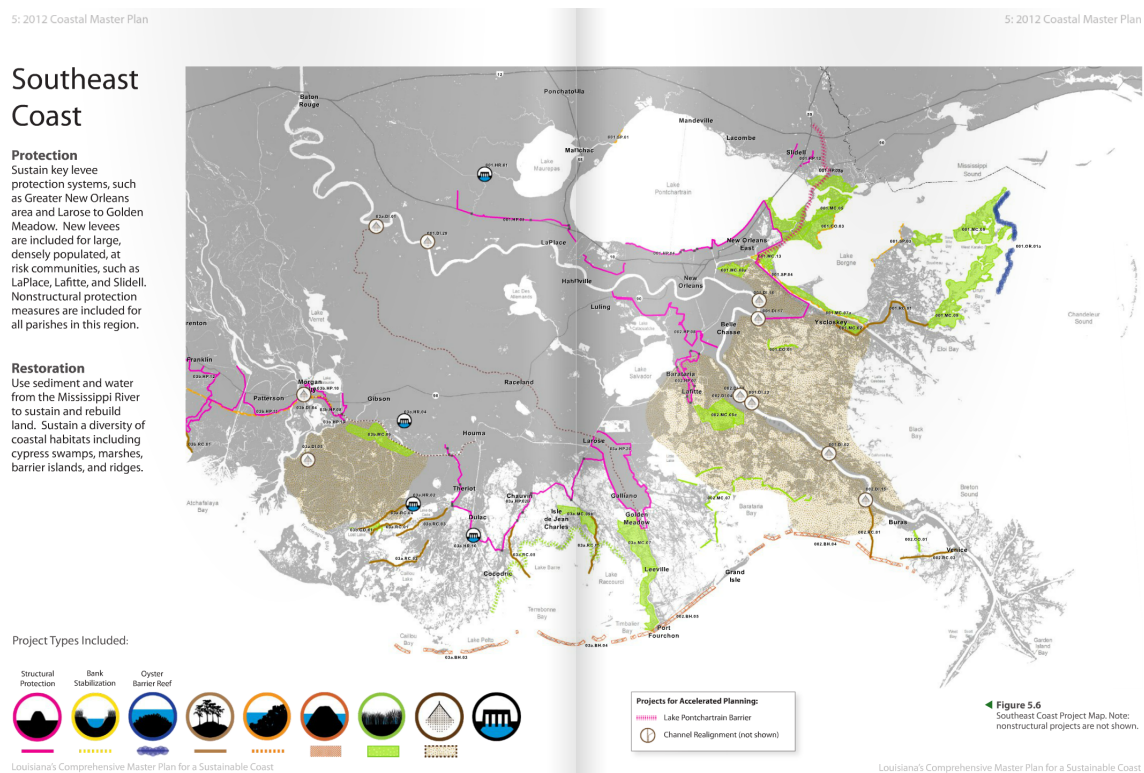


Figure 2.5: Southeast Coast

In 2009, MRGO was closed by two huge structure, obtruding the water coming from the Gulf into further inlands. In the meantime, a lot of merits have been gathered to work toward a more resilient coast.

2.2 Site Context

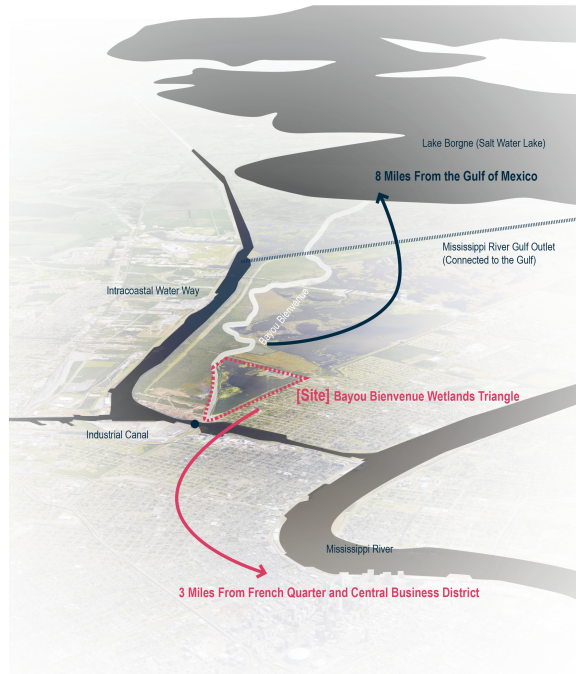


Figure 2.6: Site Context

2.2.1 Location

The site is close to both the center of the City and the Gulf. It is approximately three miles away from French Quarter and Central Business District of New Orleans and eight miles away to Lake Borgne, a lake at the Gulf. Bayou Bienvenue is a connection between urban drainage system and the Gulf. One end of Bayou Bienvenue is Pumping Station No.5, which drains all the runoff from the neighborhood. The other end runs into Lake Borgne.

The site, Bayou Bienvenue Wetlands Triangle, currently accomodating overflow from Bayou Bienvenue, locates between Bayou Bienvenue and the Lower Ninth Ward Community.

2.2.2 Neighborhood Connection

- The Lower Ninth Ward, Adjacent highlights

The Lower Ninth Ward is one of the lowest income neighborhood in New Orleans.

The history of this neighborhood exhibits enduring suffering and unrest efforts toward survival and thrive. After the Inner Harbor Navigation Canal was built in 1923, immigrant workers came to this area. Back then it was still disease breeding swamps, any people who can afford to live somewhere else would not end up there. However, as the development of drainage techniques, this area was finally drained and sold to mostly poor people, enabling them to own a piece of land, and pass it as heritage to their decedents. Before the Hurricane Katrina in 2005, this area tops the neighborhood with the highest home ownership in New Orleans.

The segregation of this area started in 1960s, when the school was forced to desegregate, white people move to St. Bernard Parish to avoid letting their kids share a classroom with African Americans. After that, the residents in the Lower Ninth ward were dominantly African Americans.

As the area with the lowest income, highest percentage of African American home ownership, this area was constantly ignored in any of the city's endeavor of development. On the contrary, it became a place for city to locate its unwanted infrastructure, such as sewerage treatment plant, power station, scrap metal recycling and landfill. While they are the last neighborhood in New Orleans to have drainage and sewerage infrastructure. The neglected attitude of the city nurtured residents' distrust. In xxxx, Chalmette neighborhood was wiped out as part of national historic park. Most tenants from Chalmette were relocated to the Lower Ninth ward. An event like this further expanded the gap between the city and the residents in the Lower Ninth Ward, making it even more difficult to recover this neighborhood.

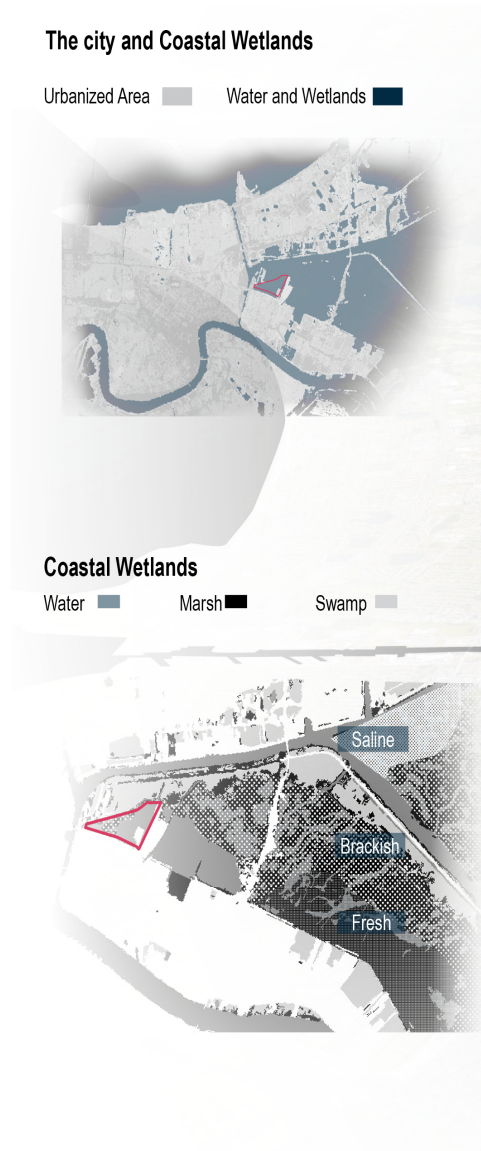


Figure 2.7: Neighborhood Connection

- Ecological Context

Sitting in the middle of a salinized fresh water system, the surrounding ecological community can be roughly divided into saline wetlands, brackish wetlands and fresh water wetlands.

Fresh water wetlands, nurtured by rivers or bayous, accommodate a wide range of species, including domestic ones and migrating birds traveling along the Mississippi Flyway.

A diverse ecosystem will definitely help to prepare the neighborhood against the future challenge posed by subsidence, coastal erosion and climate change.

- Urban Context

Located in one of the most isolated neighborhood in New Orleans, the Lower Ninth Ward, BBWT's existence is relatively unknown, until the fatal disaster Hurricane Katrina raised public awareness of the significance of coastal wetlands.

- a. Land Use



Figure 2.8: Land Use of the site

The lower Ninth Ward is mainly occupied by residential areas. The major commercial areas are on St. Claude Avenue, which also passed French Quarter and CBD (Central Business District), and Caffin Avenue, on which also located the only existing entrance to the site.

b. Green Space

Green Space

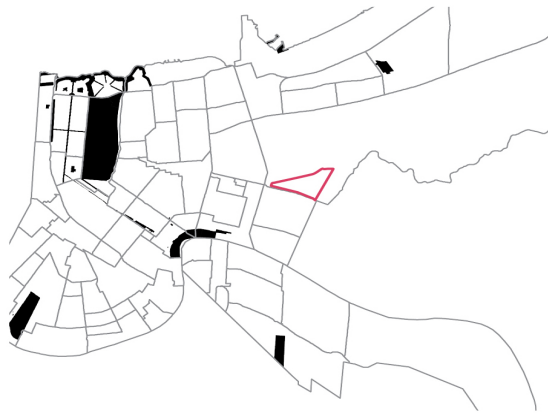


Figure 2.9: Green Space

According to the Land Use map, the major green space inside the city are distant from the site, which means the site will provide essential green space for adjacent neighborhoods, especially the Lower Ninth Ward.

c. Roads

Roads



Figure 2.10: Road Networks

There are three roads connecting the neighborhood to the rest of the city, Florida Avenue, North Claiborne Avenue and St. Claude Avenue. Moreover, the Florida Avenue connection has a railroad running through French Quarter.

All the roads parallel to the Mississippi River were once connected to the west bank of the industrial Canal. However, when Industrial Canal was built in 1923, the connection is broken. Nowadays, the names of the roads are still the same on both bank of the Industrial Canal, although they are no longer connected.

d. Building Footprints



Figure 2.11: Building Footprints



Figure 2.12: Building Footprints from a satellite image

Devastated in 2005 by Hurricane Katrina, most houses close to BBWT have not been

built back. Recent recovery efforts, including Martin Luther King High School and Lee Playground, expresses interest in developing vacant lots close to BBWT.

e. Population Density

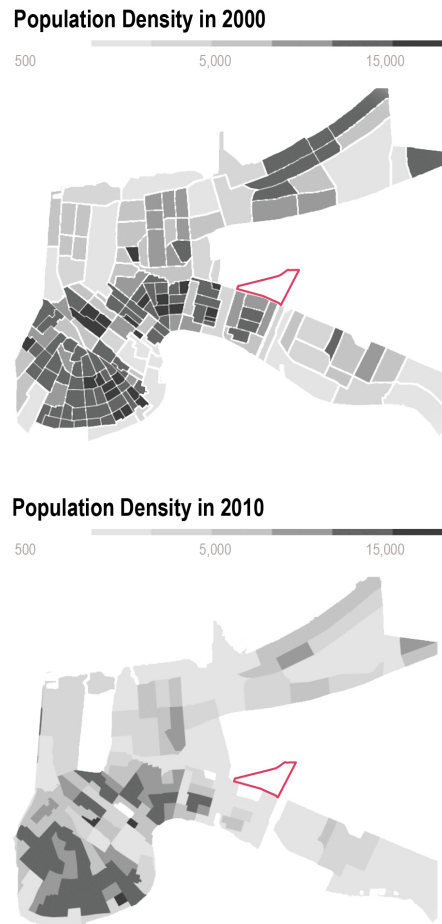


Figure 2.13: Population Density

Hurricane Katrina has drastically altered the demographic of New Orleans. Lower Ninth Ward, one of the most severely hit areas during the Hurricane, has a extremely difficult time recovering. Most residents failed to come back after Hurricane Katrina. According to New Orleans Data Center, from 2000 to 2010, while the nationwide population experienced a 9.7% increase, the number of households in Orleans Parish decreased by 23.4% from 188,251 to 142,158. During the same time period, the number of households in the Lower Ninth Ward decreased by 78.0% from 4,820 to

1,061.

2.3 Existing Site Condition

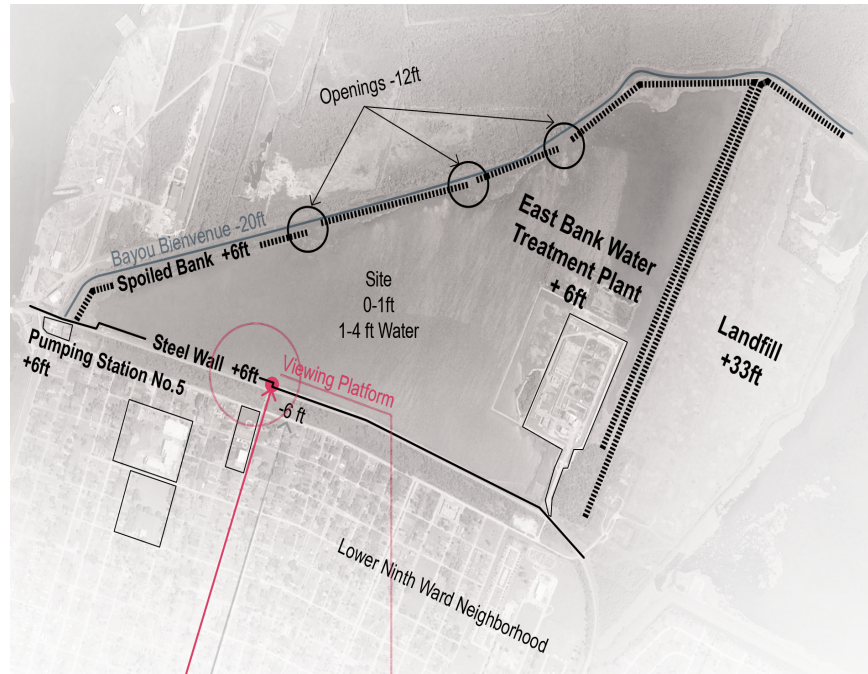


Figure 2.14: Existing Site Condition

2.3.1 Water



Figure 2.15: Existing Water Condition

The water is getting fresher and fresher since the closure of Mississippi River Gulf Outlet in 2009. A lot of fresh water aquatic plants, especially water hyacinth and bull tongues, have occupied extensive water bodies in and close to BBWT.

2.3.2 Ecosystems and Animals



Figure 2.16: Ecosystems and Animals

A lot of fresh water species are living on the site at present. A large variety of species has been spotted. Including: Bird: Ducks, Herons(Blue and Grey), Aspris, Eagle, Skimmer, Pelican(Brown and White), Egress, Sea Gulls, Red Birds(Cardinal), Hawk(Grey Tail and Gauss), Spoonbill Mammals: Otters, Swamp Rabbit, Wild Hog, Nutria, Muskrat, Raccoon, Kayoti, Mink, White Tail Deer(Southern Scrap Side)l..... Arthropod: Crayfish, Crab(Blue Crab)..... Reptile: Alligators, Snakes, Moccasin, Salamander, Alligator, Southern Snapping Turtles..... Amphibian: Frog, Toad, Lizards, Apple Snail..... Fish: Garfish, Catfish, Red Fish, Trout(Salt Water), Drum Fish, Choupic, Bass, Sheephead, Yellow Perch.....

2.3.3 Lower Ninth Ward Neighborhood

Lower Ninth Ward(LNW) has long been considered as, by people from other neighborhoods of the city, an area with crimes, poverty and evidence of urban inequality. Improvements of this area, currently and historically, are largely earned by residents' enduring campaigns, coming from a strong sense of ownership. Households here has been passed on from generations to generations, building up a neighborhood filled with memories and pride. However, Hurricane Katrina in 2005 destroyed this neighborhood. Close to Bayou Bienvenue, the houses were mostly wiped out, the lots were filled with standing water as deep as 21 feet for more than two weeks. Other parts of the neighborhood took hit from the catastrophe. The houses were taken down, the commercial activities are barely seen after more than 10 years of the Hurricane. Residents struggled to come back, however, only a small portion of them manage to. According to New Orleans Data Center, from 2000 to 2010, while the nationwide population experienced a 9.7% increase, the number of household in Orleans Parish decreased by 23.4% from 188,251 to 142,158. During the same time period, the number of households in the Lower Ninth Ward decreased by 78.0% from 4,820 to 1,061. The wetlands can be seen as an amenity and an opportunity for this struggling neighborhood. The size is ideal. 472 acres of green space is a luxury for a city like New Orleans, but still manageable. What is more, it is the only spot that is inside both coastal wetlands and the city. It is a wonderful spot to watch wetlands species, and migrating birds through out the year. Moreover, the interaction between fresh water and salt water gifted this areas with all kinds of animals. Currently, BBWT hundreds of visitors on daily basis. In the future, more and more people will come here for sight seeing, bird watching, fishing and other activities.

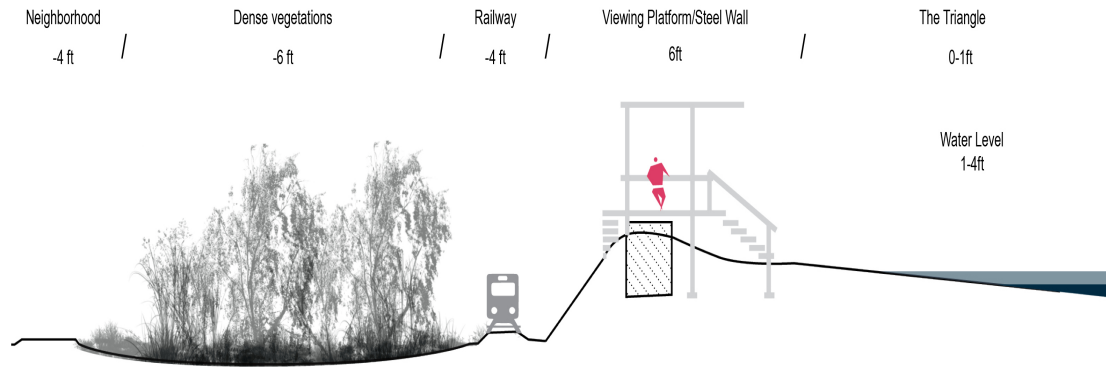


Figure 2.17: Existing Platform

Lots of residents from younger generation do not acknowledge the existent of this wetlands due to a series of physical separation between the wetlands and the community. Between Florida Avenue and BBWT, there is a vegetation belt blocking views and access to the wetlands. Besides, there is a railway, further divided people and BBWT, physically and visually. Last, is the six-feet steel wall, established in 1960s. It totally blocked people's access until a platform was built in 2006, one year after Hurricane Katrina. Right now, this platform is single access and view point residents and tourists can access if they want to enter the wetlands, or just enjoy the view.



Figure 2.18: Existing Platform II

2.4 Existing Fresh Water Resources

2.4.1 Pumping Station No.5



Figure 2.19: Motors and Pumps inside Pumping Station No.5

The daily salt water input caused by tidal influence altered the water level by 6 inches to 1 foot. The site is 472 acres thus daily salt water input is 10,280,150 to 20,560,320 cubic feet. There are two existing facilities that contain large volume of fresh water. The first one is Pumping Station No.5 (PS 5), which collects all the surface runoff of the Lower Ninth Ward (approximately 1,900 acres). The other one is East Bank Wastewater Treatment Plant (EBWWTP), which treats all the sewerage of Orleans Parish East Bank, about 160,000,000 gallons per day on average [11].

Pumping Station No. 5 have three different discharge scenarios based on the severity of rainfall. According to the rainfall reoccurrence record provided by NOAA [4], under most circumstances, only the slight rainfall scenario needs to be applied, pumping 400 cubic feet of water per second into Bayou Bienvenue. For this scenario, the water coming from street will not be carrying a lots of debris and pollutants. New Orleans receives 64 inches of rainfall on yearly basis, thus 441,380,412 cubic feet of water can be used to reduce the salinity on site.

2.4.2 East Bank Wastewater Treatment Plant

EBWWTP (East Bank Wastewater Treatment Plant) has relatively stable fresh water output on daily basis. Currently, the facility treats 160,000,000 gallons of wet sewer, exporting 7,000,000 cubic feet of fresh water to the Mississippi River [12]. The treatment process takes out 91 milligram TSS(total suspended solid), adding up to 36,000 kg on daily basis.

2.5 Existing Fresh Water Resources

2.5.1 Pumping Station No.5



Figure 2.20: Inside The East Bank Wastewater Treatment

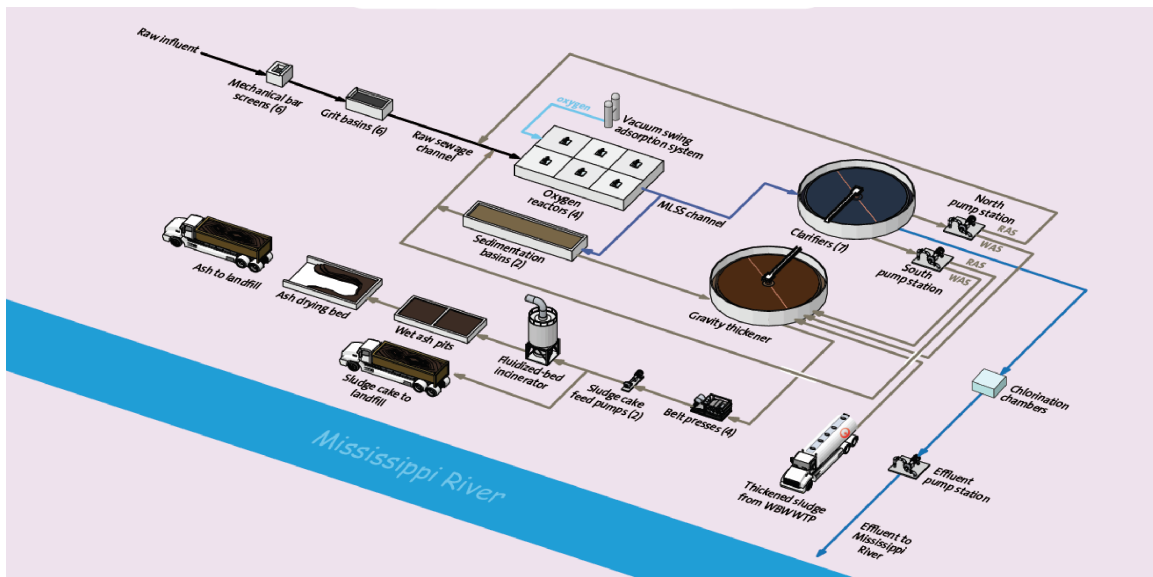


Figure 2.21: Inside The East Bank Wastewater Treatment

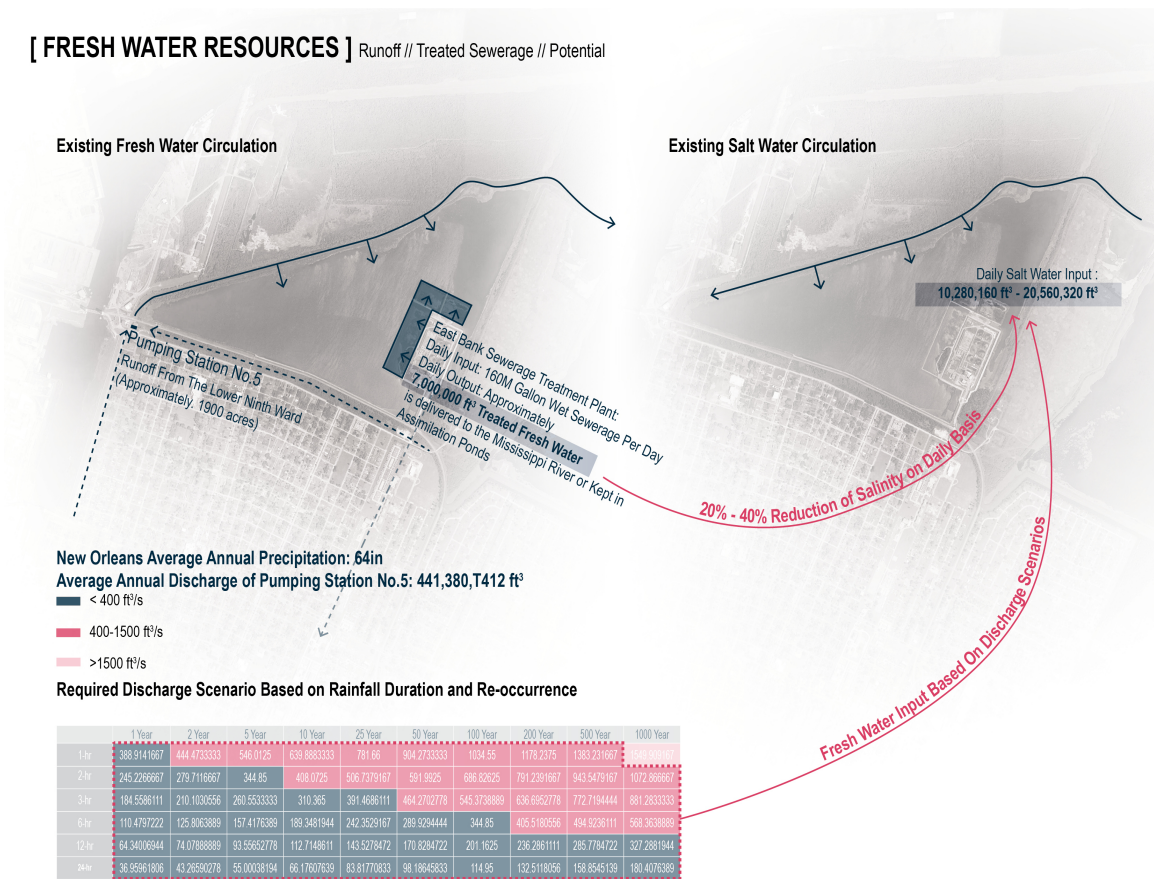
In 2012, two assimilation ponds were built outside EBWWTP as experiment fields to recover the BBTW. In 2015, the third pond was built. Right now, there are three ponds, approximately 35 acres in total, on the north and west side of the EBWWTP. Both plant and animal species in these assimilation ponds indicate low level of salinity. More than three big alligators(more than 10ft) were spotted recently(March 2016).

2.5.2 The Potential Of Existing Fresh Water Resources

This two facility has huge potential to decline the salinity of BBWT. The fresh water coming out out EBWWTP everyday, currently goes directly to the Mississippi River, can decline the salinity of the input from the Gulf by 20-40%. On the other hand, locating at the tip of the BBWT, fresh water from PS 5, can not only support existing fresh water ecosystems, but contribute to creating a designated fresh water area within BBWT.

Chapter 3

Site Inventory and Analysis



There are two facilities in the charge of the Sewerage and Water Board of New Orleans inside the site. They have large amount of fresh water, which could potentially help to reduce the salinity.

Figure 3.1: Existing Salt Water Intrusion

The design strategy comes from managing existing fresh water resources on the site. Maximizing the input of existing fresh water resources to offset unstable salt water input from the Gulf will be the foundation of this project.

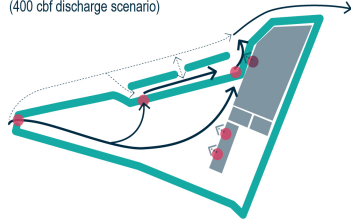
3.1 Managing The Water: A Battle Against Salt Water Intrusion

[PROPOSED WATER CIRCULATION] Fresh Water // Salt Water

Fresh Water Circulation

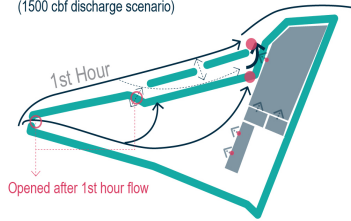
- Opened Weirs (Debris controlling and monitoring)
- Conditionally Opened Weirs (Opened when standards are met)

Constant Duty
(400 cbf discharge scenario)



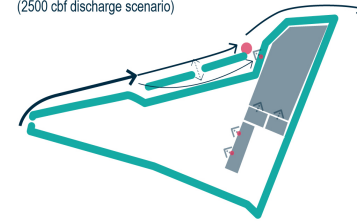
During slight rainfall, most water will enter the site directly.

Heavy Rainfall
(1500 cbf discharge scenario)



During Heavy Rainfall, the first hour discharge will not enter the site because of pollutants and debris from street that might come with the water.

Full Capacity
(2500 cbf discharge scenario)

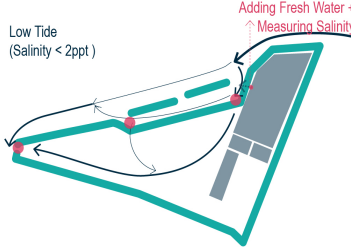


This is a rare scenario, when the site merely serve as overflow.

Salt Water Circulation

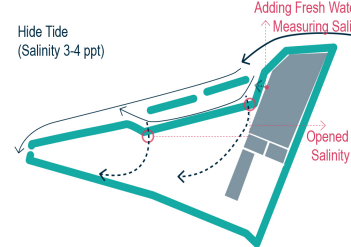
- Opened Weirs (Debris controlling and monitoring)
- Conditionally Opened Weirs (Opened when standards are met)

Low Tide
(Salinity < 2ppt)



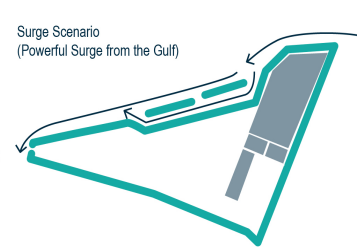
Daily low-salinity water from the Gulf.

High Tide
(Salinity 3-4 ppt)



When strong wind causes increasing input of salt water.

Surge Scenario
(Powerful Surge from the Gulf)



All the weirs are closed to protect the neighborhood.

Figure 3.2: Existing Water Circulation

Proposed water system consist of landform modification and controlling weirs. A vegetation strip will be created inside the wetlands, dividing existing water into two. One of them is working as over flow of Bayou Bienvenue, supporting an ecosystem more accustomed to fluctuate salinity and fast moving water. The other will be mainly fed by fresh water coming from PS 5 and EBWWTP, slow moving water and abundant fresh water will transform this area from a pond to marshes and swamps.

3.2 Proposed Water System

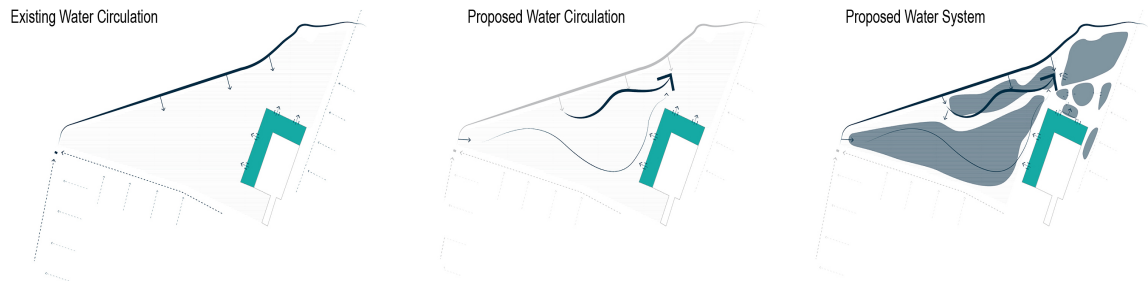


Figure 3.3: Proposed Water System

Proposed water system consists of 3 parts. The south part, receiving fresh water from EBWWTP and PS 5, will become marsh and swamps. EBWWTP area will support ongoing experiment and future wetland recovery research by providing various water bodies. Close to the third opening and a toxic landfill, the research area can also serve as a barrier that protects the rest of BBWT and the Lower Ninth Neighborhood. Last, accommodating unrest battles between fresh water and salt water, the over flow of Bayou Bienvenue will be an enrichment to the rest of fresh water systems. Compared to the rest of BBWT, this area will have deeper and faster-moving water, making it a habitat for some saltwater species, and those who prefer river ecosystem to marshes and swamps.

3.3 Proposed Ecosystems



Figure 3.4: Proposed Ecosystems

Currently, most animals living in and around BBWT are on spoiled bank, in EBWWTP and in Crescent Acre Landfill. A more diverse community will grow out of the proposed water system.

Close to the tip of the triangle and PS 5 exists active animal activities. A lot of traces by rabbits, birds, snakes and other species are left every where on spoiled bank. By turning into a marsh, more animals will settle here, providing recreational resources for residents and tourists. Spoiled bank and the vegetation strip in the middle will become home to mammals and other species that live on the land. The major water body will be in the middle of the wetlands, allowing various fishes, reptiles and arthropods, including crawfish, catfish and alligators. The Experiment area, including agricultural fields, treatment ponds and an indicator pond, will nurture the growth of cypress swamp and other types of wetlands.

3.4 Proposed Circulation and Views

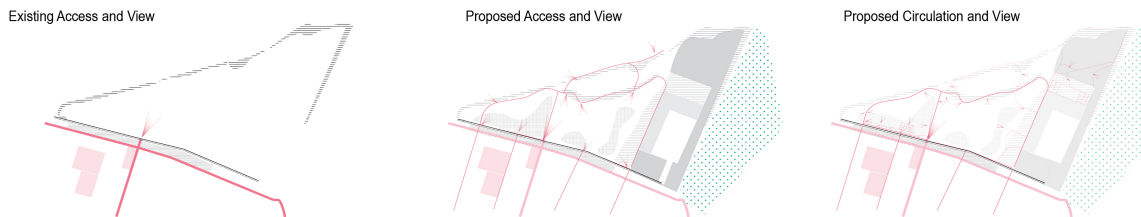


Figure 3.5: Proposed Circulation and Views

Existing solo access and view point is platform on Caffin Avenue. Between BBWT and the neighborhood are a series of physical separation, avoiding people to acknowledge and access the site. Proposed access is a 0.75-mile boardwalk along the steel wall at the south edge of BBWT. Besides, viewing platform will be at the ends of Reynes Street, Andry Street, Alabo Street and Tupelo Street, to declare the existence of a 472-acre green space as well as provide convenient access. The circulation inside BBWT will enable visitors to tour around every feature while enabling them to take short cuts back to the entrances. Platforms, amphitheaters and sitting structures will allow people to stop for a rest, pictures and reading educational signs.

Chapter 4

Design Proposal

4.1 Design Process

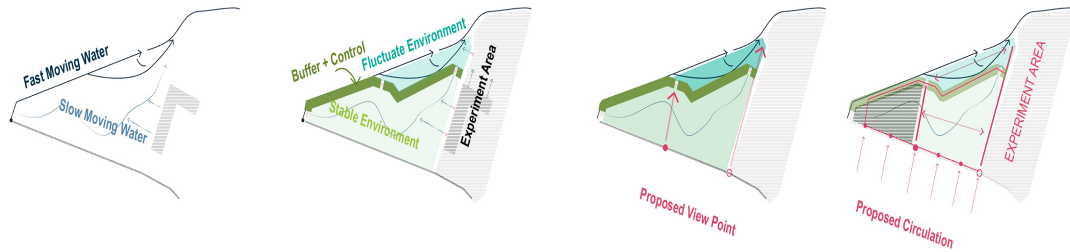


Figure 4.1: Design Process

The area is finally divided into 4 parts, based on accessibility and ecosystem types, providing visitors with different experience and alternatives.

4.2 Master Plan

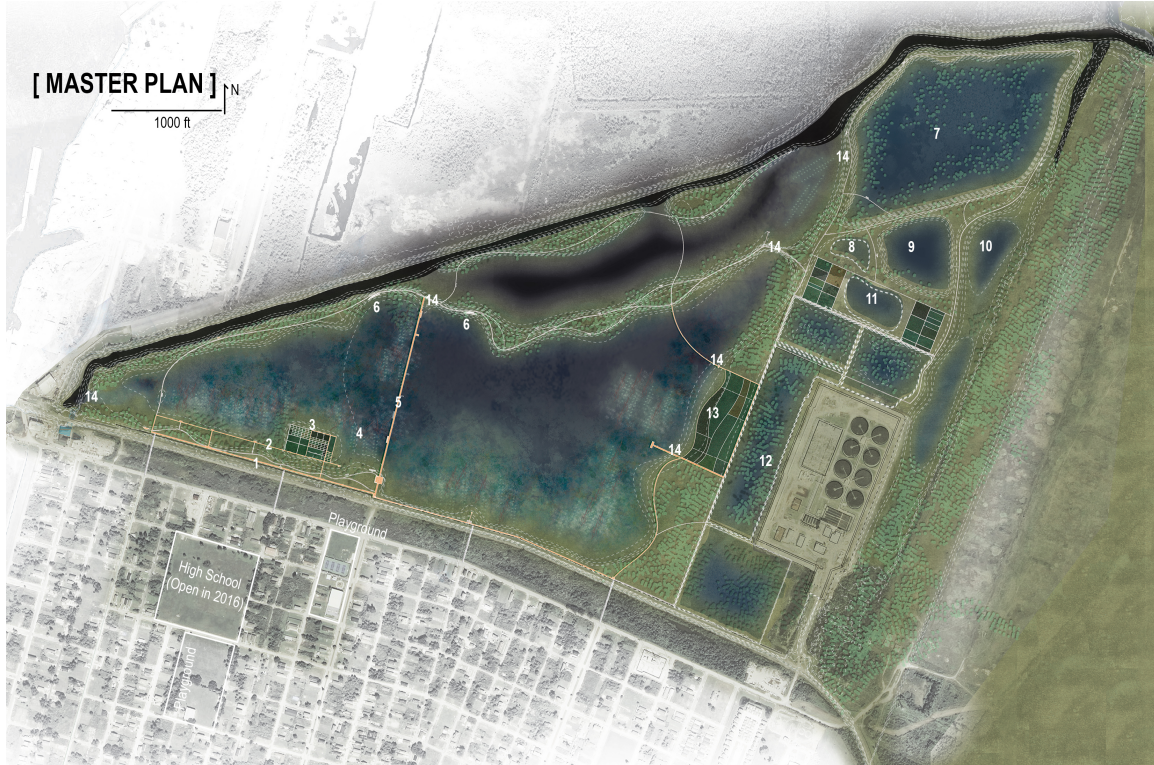


Figure 4.2: Master Plan

Master Plan Design Features includes: 1. Steel Wall Board Walk; 2. Wetlands Board Walk; 3. High School Experimental Field; 4. Cypress Trunk Gardens; 5. Educational Board Walk; 6. Amphitheater; 7. Salinity Control Pond; 8. Chemical Control Pond; 9. Water Quality Control Pond; 10. Landfill Runoff Control Pond; 11. Wetland Plant Experiment; 12. Existing Assimilation Ponds; 13. Plant Adaptation Area; 14. Weirs Controlling Water Flow

4.3 Design Features

4.3.1 Steel Wall Boardwalk

A boardwalk going along the 6ft steel wall to create a visual connection from the neighborhood to the site. This boardwalk will also allow people to access the wetlands from multiple entrances, providing more convenient access for residents and tourists.

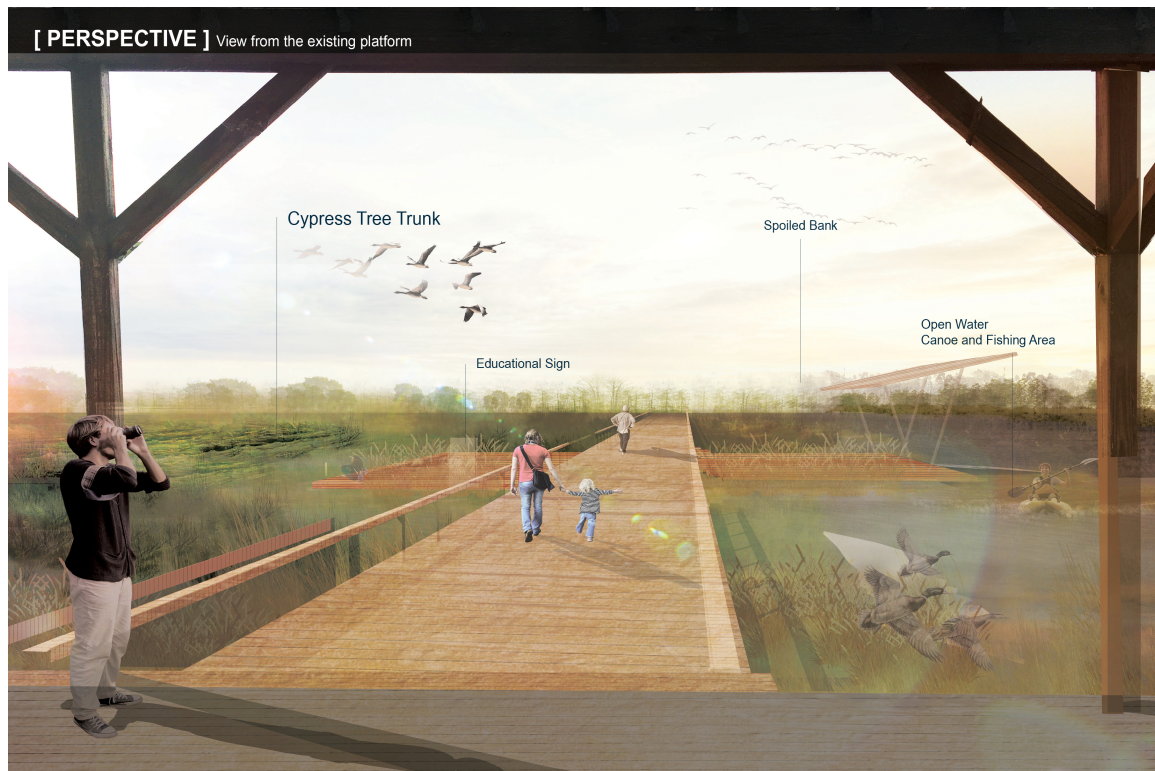


Figure 4.3: Steel Wall Boardwalk

4.3.2 Wetlands boardwalk

It provide people with close access to the water inside Bayou Bienvenue Wetlands Triangle. The Changing water level will exhibit different views throughout the year.

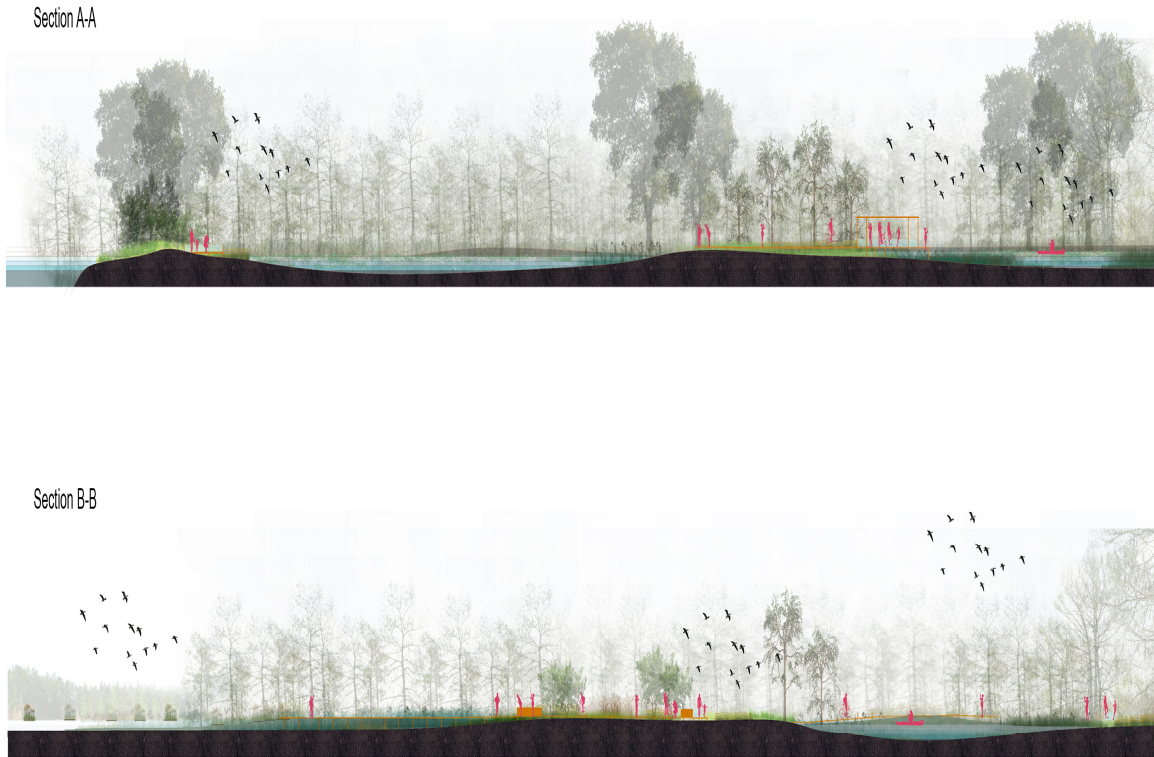


Figure 4.4: Wetlands boardwalk

4.3.3 High School Experiment Field

A new high school will open this year 2 blocks away from the wetlands. This experiment field will enable students to get close to see the subtle water change inside the wetland, and learn about coastal water systems.

4.3.4 Cypress Trunk Gardens

Cypress trees stand for a while after their death. Right now, hundreds of dead trees are still standing in the water. More trees have been carried by water to the tip of the triangle over the years, floating on the water, creating new space for growth of plants, attracting numerous animals to live here. By opening part of spoiled bank to create a direct freshwater input from the Pumping Station No.5, the trunks will be washed down.

Floating trunks will be stopped by floating islands and a long boardwalk, accelerating the recovery of freshwater marshes.

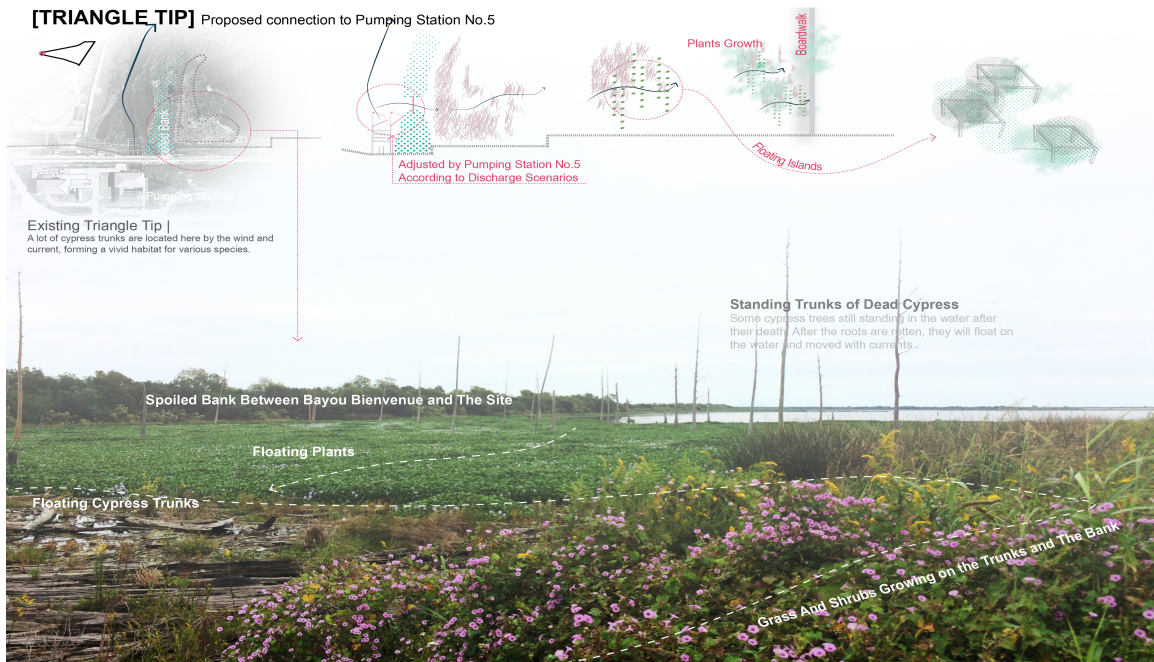


Figure 4.5: Cypress Trunk Gardens

4.3.5 Educational Boardwalk

This boardwalk enables people to get deep inside the wetlands. Benches, platform, educational signs are placed along the boardwalk to introduce the unique history of Bayou Bienvenue Wetlands Triangle.

4.3.6 Experiment Area Around East Bank Wastewater Treatment (EBWWTP)

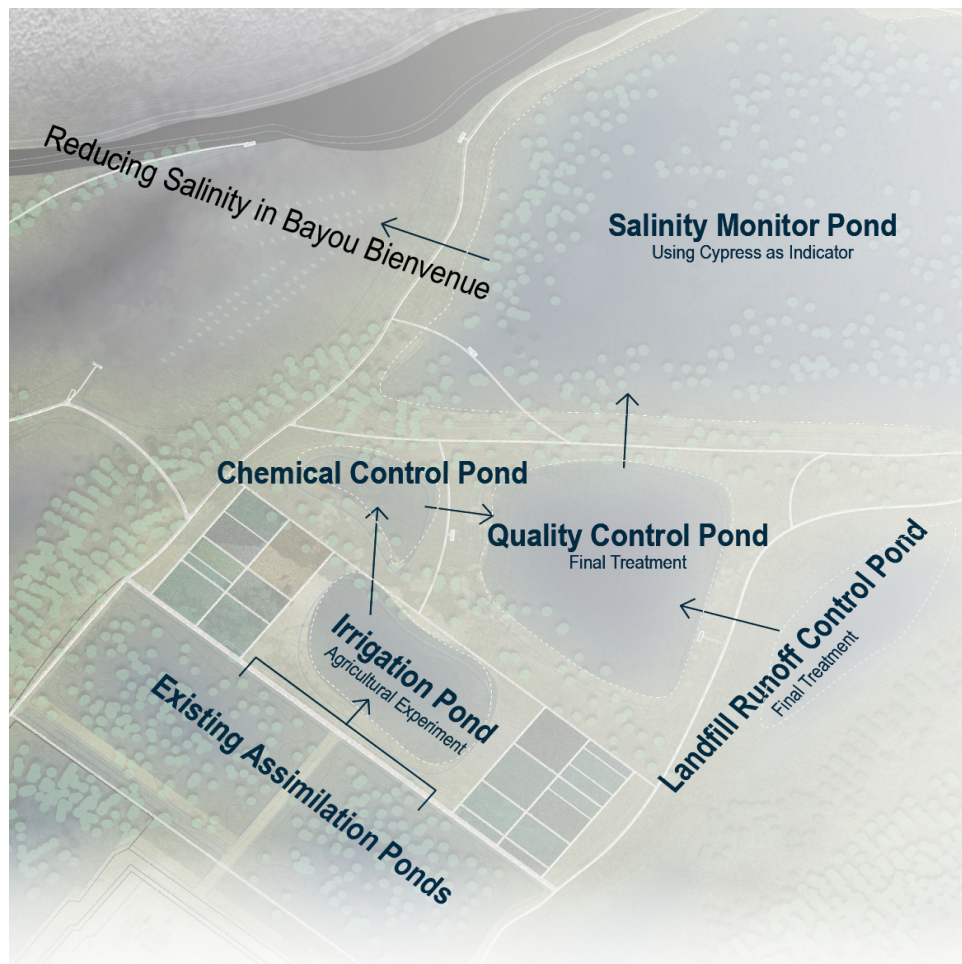


Figure 4.6: Experiment Area Around East Bank Wastewater Treatment

EBWWTP has been conducting experiments for years on wetland recovery. This area is dedicated to experiments on water treatment and fertilizer research, supervised by EBWWTP.

4.3.7 A Sustainable Future For the Lower Ninth Ward

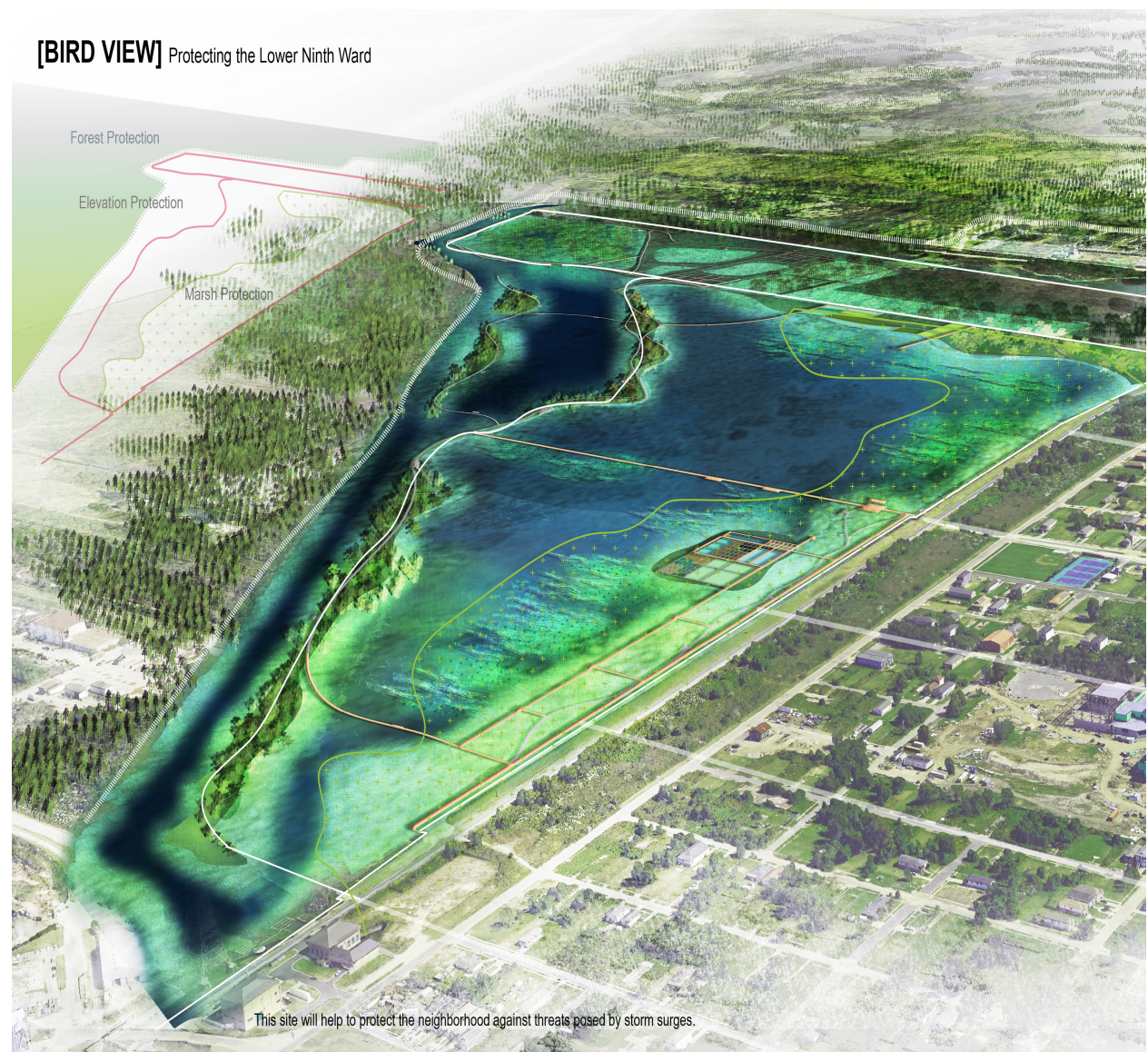


Figure 4.7: Experiment Area Around East Bank Wastewater Treatment

This area will provide multiple layers of defense toward future challenge posed by climate change, coastal erosion and subsidence. This 472-acre green space will protect the Lower Ninth Ward neighborhood, while providing essential recreational space to residents. Besides, this green assets, together with other ongoing recovery efforts, will attract investment and business interest, thus help recover and revitalize the neighborhood.

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Vita

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